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SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	**Application No.** 10/615,649	**Applicant(s)** NUCCI ET AL.	
	Examiner Leah L. Richmond	**Art Unit** 2112	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 July 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/17/03, 02/19/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 12 and **13** are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Consider **Claim 12**, the "computer readable media," in accordance with Applicant's specification, may be an electromagnetic signal (see paragraphs [0038] and [0039]). This subject matter is not limited to that which falls within a statutory category of invention because it is not limited to a process, machine, manufacture, or a composition of matter. Instead, it may include a form of energy. Energy does not fall within a statutory category since it is clearly not a series of steps or acts to constitute a process, not a mechanical device or combination of mechanical devices to constitute a machine, not a tangible physical article or object which is some form of matter to be a product and constitute a manufacture, and not a composition of two or more substances to constitute a composition of matter.

Consider **claim 13**, the "computer readable media," in accordance with Applicant's specification, may be an electromagnetic signal (see paragraphs [0038] and [0039]). This subject matter is not limited to that which falls within a statutory category of invention because it is not limited to a process, machine, manufacture, or a composition of matter. Instead, it may include a form of energy. Energy does

not fall within a statutory category since it is clearly not a series of steps or acts to constitute a process, not a mechanical device or combination of mechanical devices to constitute a machine, not a tangible physical article or object which is some form of matter to be a product and constitute a manufacture, and not a composition of two or more substances to constitute a composition of matter.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
> manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was

not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 2, 3, 4, 5 and **12** are rejected under 35 U.S.C. 103 as being unpatentable over **Doverspike et al. (U.S. Patent Application Publication # 2002/0097671 A1)** in view of **Wolpert (U.S. Patent # 6577601).**

Consider **claims 1** and **12,** Doverspike et al. clearly show and disclose computer readable media having instructions for and a method for identifying optimal mapping of logical links to the physical topology of the network, comprising: obtaining one or more mapping options for mapping multiple logical links between one or more pairs of network nodes onto physical paths that are at least relatively disjoint and identifying the optimal mapping using a cost metric to assign a weight to the paths (Col. 1, paragraph [0006]: "The restoration path is selected from a graph of links in the network which are physically diverse from the service path. For example, in the context of optical networking, the links do not share a common fiber span with the service path." and Col. 3, paragraph [0021]: "Selecting a service path in response to the communication request, accordingly, may be accomplished by computing a path between the source and destination that minimizes some cost metric and which has the required size for the connection request. It is assumed that each OXC node has knowledge of the whole optical network topology and the number of free channels on each link as well as some optical link weight function. A known shortest path algorithm such as Dijkstra's shortest

path algorithm may be used to compute the minimal weight path through the network." and Col. 3, paragraph [0019]: "The process of computation of service path and restoration path for a connection request relies on the information about the availability of optical network resources and the path selection objective. A general heuristic is to create some cost metric and select a "minimum weight" path among all suitable paths that minimizes the cost metric and has the required size for the connection request."). Doverspike et al. do not disclose obtaining a maximum time delay allowed between each pair of network nodes and using this time delay as the cost metric to identify the optimal mapping. However, Wolpert clearly shows and discloses obtaining a maximum time delay and using it to identify the optimal mapping (Col. 3, lines 52 –59: "The objective of the invention is to optimize some measure of network performance, such as overall entity throughput, ..., average or minimum or maximum time delay for entity delivery, priority level for an entity, or some other measure of quality of service (QOS) on the network."). Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use maximum time delay as the cost metric, as in Wolpert, in the method for identifying optimal mapping of logical links to the physical network topology as in Doverspike et al. for the purpose of selecting the optimal logical path that meets a defined time constraint.

Consider **claim 2**, and as applied to claim 1, Doverspike et al. do not disclose obtaining a relative time delay allowed between two or more physical paths. However, Wolpert clearly shows and discloses obtaining a relative time delay and using it to identify the optimal mapping (Col. 5, lines 51 –59: "This cost, referenced to a particular

i-to-j link, may be the maximum or minimum or average bandwidth available ..., the time delay associated with use of that link, ... or some other suitable measure of cost of using the particular link." and Col. 8, lines 43 – 46: "The preceding development identifies the i-to-j'(u) link for entity transport, using a maximum difference of two J(u)-component vectors, Target and Actual, that are determined iteratively."). Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to obtain the relative time delay allowed between two or more physical paths as in Wolpert and use it as a cost metric in the method for identifying optimal mapping of logical links to the physical network topology as in Doverspike et al. for the purpose of selecting the optimal logical path that meets a defined time constraint.

Consider **claim 3**, and as applied to claim 2, Doverspike et al. clearly show and disclose identifying the optimal mapping of logical links using a cost metric to assign a weight to the paths (Col. 3, paragraph [0019]: "The process of computation of service path and restoration path for a connection request relies on the information about the availability of optical network resources and the path selection objective. A general heuristic is to create some cost metric and select a "minimum weight" path among all suitable paths that minimizes the cost metric and has the required size for the connection request."). Doverspike et al. do not disclose using the maximum time delay and the relative time delay as cost metrics to identify the optimal mapping. However, Wolpert clearly shows and discloses using maximum time delay and relative time delay as cost metrics to identify the optimal mapping (Col. 5, lines 51 –59: "This cost, referenced to a particular i-to-j link, may be the maximum or minimum or average

bandwidth available ..., the time delay associated with use of that link, ... or some other suitable measure of cost of using the particular link." and Col. 8, lines 43 – 46: "The preceding development identifies the i-to-j'(u) link for entity transport, using a maximum difference of two J(u)-component vectors, Target and Actual, that are determined iteratively."). Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use maximum time delay and relative time delay as cost metrics as taught by Wolpert in the method for identifying optimal mapping of logical links to the physical network topology as in Doverspike et al. for the purpose of selecting the optimal logical path that meets defined time constraints.

Consider **claim 4**, and as applied to claim 3, Doverspike et al. clearly show and disclose a method further comprising obtaining the availability of wavelengths in a network (Col. 1, paragraph [0006]: "Weights are computed for the links using an array representing a restoration link capacity – which is expressed as a number of channels/wavelengths in optical networking...").

Consider **claim 5**, and as applied to claim 4, Doverspike et al. clearly show and disclose identifying the optimal mapping of logical links using a cost metric to assign a weight to the paths (Col. 3, paragraph [0019]: "The process of computation of service path and restoration path for a connection request relies on the information about the availability of optical network resources and the path selection objective. A general heuristic is to create some cost metric and select a "minimum weight" path among all suitable paths that minimizes the cost metric and has the required size for the connection request."). Doverspike et al. also disclose that link capacity is expressed as

a number of wavelengths in optical networking (Col. 1, paragraph [0006]: "Weights are computed for the links using an array representing a restoration link capacity – which is expressed as a number of channels/wavelengths in optical networking…"). Doverspike et al. do not disclose using the maximum time delay and the relative time delay as cost metrics to identify the optimal mapping. However, Wolpert clearly shows and discloses using maximum time delay and relative time delay as cost metrics to identify the optimal mapping (Col. 5, lines 51 –59: "This cost, referenced to a particular i-to-j link, may be the maximum or minimum or average bandwidth available …, the time delay associated with use of that link, … or some other suitable measure of cost of using the particular link." and Col. 8, lines 43 – 46: "The preceding development identifies the i-to-j'(u) link for entity transport, using a maximum difference of two J(u)-component vectors, Target and Actual, that are determined iteratively."). Doverspike et al. in view of Wolpert do not disclose using the link capacity as a cost metric to identify the optimal mapping. Nonetheless, Examiner takes Official Notice that it is notoriously well-known in the art to use link attributes, such as capacity, in defining link costs. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use maximum time delay and relative time delay as taught by Wolpert and wavelength availability as cost metrics in the method for identifying optimal mapping of logical links to the physical network topology as in Doverspike et al. for the purpose of selecting the optimal logical path.

Claims 6, 7, 11 and **13** are rejected under 35 U.S.C. 103 as being unpatentable over **Doverspike et al. (U.S. Patent Application Publication # 2002/0097671 A1)** in view of **Wolpert (U.S. Patent # 6577601)** and in further view of **Nishiyama et al. (European Patent # EP950966).**

Consider **claim 6**, and as applied to claim 5, Doverspike et al. in view of Wolpert do not disclose obtaining a priority order of the network node pairs. However, Nishiyama et al. clearly show and disclose obtaining a priority order of the network node pairs (paragraph [0009]: "... the object above can be achieved in the method by providing a sixth step in which when positional relationships between nodes at a reference level or nodes as a reference of placements are determined, ... and a seventh step for determining positional relationships such that a pair having the higher priority is located at the nearer position."). Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate obtaining a priority order of the network node pairs as in Nishiyama et al. into the method for identifying optimal mapping of logical links to the physical topology of a network as in Doverspike et al. and Wolpert for the purpose of using the priority order of the network node pairs in determining the optimal logical link mapping.

Consider **claims 7** and **13**, and as applied to claim 6, Doverspike et al. in view of Wolpert clearly show and disclose computer readable media having computer-executable instructions for and a method for identifying the optimal mapping of logical links using a cost metric to assign a weight to the paths (Doverspike et al., Col. 3, paragraph [0019]: "The process of computation of service path and restoration path for

a connection request relies on the information about the availability of optical network resources and the path selection objective. A general heuristic is to create some cost metric and select a "minimum weight" path among all suitable paths that minimizes the cost metric and has the required size for the connection request."). Doverspike et al. also disclose that link capacity is expressed as a number of wavelengths in optical networking (Col. 1, paragraph [0006]: "Weights are computed for the links using an array representing a restoration link capacity – which is expressed as a number of channels/wavelengths in optical networking…"). Doverspike et al. do not disclose using the maximum time delay and the relative time delay as cost metrics to identify the optimal mapping. However, Wolpert clearly shows and discloses using maximum time delay and relative time delay as cost metrics to identify the optimal mapping (Col. 5, lines 51 –59: "This cost, referenced to a particular i-to-j link, may be the maximum or minimum or average bandwidth available …, the time delay associated with use of that link, … or some other suitable measure of cost of using the particular link." and Col. 8, lines 43 – 46: "The preceding development identifies the i-to-j'(u) link for entity transport, using a maximum difference of two J(u)-component vectors, Target and Actual, that are determined iteratively."). Doverspike et al. in view of Wolpert do not disclose obtaining a priority order of the network node pairs. However, Nishiyama et al. clearly show and disclose obtaining a priority order of the network node pairs (paragraph [0009]: "… the object above can be achieved in the method by providing a sixth step in which when positional relationships between nodes at a reference level or nodes as a reference of placements are determined, … and a seventh step for

determining positional relationships such that a pair having the higher priority is located at the nearer position."). Doverspike et al. in view of Wolpert and further in view of Nishiyama et al. do not disclose using the link capacity as a cost metric to identify the optimal mapping. Nonetheless, Examiner takes Official Notice that it is notoriously well-known in the art to use link attributes such as capacity in defining link costs. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use maximum time delay, relative time delay, wavelength availability and network node priority order as cost metrics in the method for identifying optimal mapping of logical links to the physical network topology as in Doverspike et al., Wolpert and Nishiyama et al. for the purpose of selecting the optimal logical path.

Consider **claim 11**, and as applied to claim 7, Doverspike et al. in view of Wolpert and further in view of Nishiyama et al. do not disclose utilizing the correlation to identify where new fibers or wavelengths need to be added to the network topology. However, Examiner takes Official Notice that it is notoriously well known in the art that identifying where new fibers or wavelengths need to be added to a network topology is known as capacity planning and further that it is common to use a variety of network measurements when performing capacity planning, including quality of service attributes such as delay, link attributes such as capacity and network connection attributes such as network node priority. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to utilize the correlation to identify where new fibers or wavelengths need to be added to the network technology for the purpose of performing capacity planning.

Claims 8 and **10** are rejected under 35 U.S.C. 103 as being unpatentable over **Doverspike et al. (U.S. Patent Application Publication No. 2002/0097671 A1)** in view of **Wolpert (U.S. Patent # 6577601)** and further in view of **Nishiyama et al. (European Patent # EP950966)** and further in view of **Modiano et al. (Survivable Routing of Logical Topologies in WDM Networks).**

Consider **claim 8**, and as applied to claim 7, Doverspike et al. as modified by Wolpert and Nishiyama et al. do not disclose using an integer linear program to perform the correlation. However, Modiano et al. clearly show and disclose using an integer linear program to find the optimal mapping of logical links to the physical topology of a network (Section III, Integer Linear Programming Formulation: "Using Theorem I, we are able to formulate the problem of survivable routing of a logical topology on a given physical topology as an Integer Linear Program (ILP)."). Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use an integer linear program as taught by Modiano et al. in the method for identifying optimal mapping of logical links to the physical topology of a network as in Doverspike et al., Wolpert and Nishiyama et al. for the purpose of solving the optimization problem.

Consider **claim 10**, and as applied to claim 7, Doverspike et al. as modified by Wolpert and Nishiyama et al. do not disclose performing the correlation to identify the optimal mapping for a large Internet network backbone. However, Modiano et al. clearly show and disclose performing the correlation on the NSFNET (III. Integer Linear Programming formulation, paragraph 8: "To illustrate the utility of this approach, we

implemented the ILP for the NSFNET physical topology ..."). Modiano does not specifically disclose that the NSFNET is a large Internet backbone. However, Examiner takes Official Notice that it is notoriously well-known in the art that the NSFNET is a large Internet network backbone. Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to perform the correlation to identify the optimal mapping on the NSFNET as taught by Modiano et al. using the method for identifying optimal mapping of logical links to the physical topology of a network as in Doverspike et al., Wolpert and Nishiyama et al. for the purpose of solving the optimization problem for a large Internet network backbone.

Claim 9 is rejected under 35 U.S.C. 103 as being unpatentable over **Doverspike et al. (U.S. Patent Application Publication No. 2002/0097671 A1)** in view of **Wolpert (U.S. Patent # 6577601)** and further in view of **Nishiyama et al. (European Patent # EP950966)** and further in view of **Nucci et al. ("Design of Fault-Tolerant Logical Topologies in Wavelength-Routed Optical IP Networks").**

Consider **claim 9**, and as applied claim 7, Doverspike et al. as modified by Wolpert and Nishiyama et al. do not disclose using a Tabu search methodology to perform the correlation. However, Nucci et al. clearly show and disclose using a Tabu search methodology to find the optimal mapping of logical links to the physical topology of a network (Section IV, Tabu Search for the SLTDP: "The heuristic we propose to use in the solution of SLTDP relies on the application of the Tabu Search (TS) methodology." and Section II, Problem Statement: "The Survivable Logical Topology

Design Problem (SLTDP) under a given unicast and multicast traffic pattern can be stated ..."). Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a Tabu search methodology as taught by Nucci et al. in the method for identifying optimal mapping of logical links to the physical topology of a network as in Doverspike et al., Wolpert and Nishiyama et al. for the purpose of solving the optimization problem.

Claims 14, 15, 16 and **18** are rejected under 35 U.S.C. 103 as being unpatentable over **Armitage et al. ("Design of a Survivable WDM Photonic Network ")** in view of **Wang (U.S. Patent # 5500808).**

Consider **claim 14,** Armitage et al. clearly show and disclose a computer system for identifying optimal mapping of logical links onto the physical topology of a network, with a practical constraint module comprising a mapping option sub-module for obtaining mapping options and a correlation module coupled with the practical constraint module for correlating the mapping options with a path cost metric to identify optimal mapping of logical links to the physical network topology (page 13, Simulation Results: "The DAP Algorithm has been implemented in Mathematica 2.2 for Solaris on a Sparc 20 workstation. The physical topology used for the tests was the ARPA2 network... The virtual topology has been defined by randomly generating clear-channels to obtain a (at least) biconnected network with a connectivity of 0.2..." and page 2, Definitions, paragraph 4: "The Virtual Topology consists of a graph representing all the clear-channels that are present in the network. It is the only view of

the network available to the higher layer switches. The Physical Topology is the real network, composed of optical links and photonic nodes. The mapping between these two topologies ... is performed by the design algorithm." And page 7, Design Protection, The Principle, paragraph 2: "The effects of correlated failures of many clear-channels sharing each physical link can be eliminated – or at least minimized – by using the Disjoint Alternate Path (DAP) algorithm ...The DAP algorithm maps the clear-channels onto the physical network in such a way that, for each of them, there exists an alternate path with same end-nodes, but sharing no optical link with the clear-channel to which it is associated." and page 12, paragraphs 4 and 5: "SPRA means that the shortest route is always used to route a clear-channel on the physical network. In our case, the length of a route is the number of optical links it uses. At each step of the global iteration, a Tabu Search is performed, starting from the initial solution of this step."). Armitage et al. do not disclose a maximum time delay sub-module for obtaining a maximum time delay to be used as the cost metric in determining the optimal path. However, Wang clearly shows and discloses a module for obtaining a maximum time delay (Fig. 3 and Col. 8, lines 35 – 40: "Means for generating absolute time values 230, in response to the signals from simulating means 210, 220 combines and scales the signals to obtain an absolute value of the time delay in the mapped and optimized logic network that is associated with the unmapped logic node being processed."). Therefore, it would have been obvious to a person of ordinary skill at the time the invention was made to use the module for obtaining a maximum time delay as taught by Wang in the computer system for identifying optimal mapping of logical links in Armitage

et al. for the purpose of selecting the optimal logical path that meets a defined time constraint.

Consider **claim 15**, Armitage et al. do not disclose a relative time delay sub-module. However, Wang clearly shows and discloses obtaining a relative time delay (Fig. 3 and Fig. 4 and Col. 2, lines 64 – 66: "In one improvement, referred to as the level-fanout model, a function of the fanout at a logic node is added to the constant time delay of the level model. " and Col. 3, lines 18 –20: "... the time delays are at best relative measures, which can only be used for comparisons with each other ...). Therefore, it would have been obvious to a person of ordinary skill at the time the invention was made to use the module for obtaining a relative time delay as taught by Wang in the computer system for identifying optimal mapping of logical links as in Armitage et al. for the purpose of using relative time delay between physical paths as a cost metric in identifying the optimal mapping.

Consider **claim 16,** and as applied to claim 15, Armitage et al. as modified by Wang clearly show and disclose a computer system wherein the correlation module coupled with the practical constraint module correlates the mapping options with a path cost metric (page 13, Simulation Results: "The DAP Algorithm has been implemented in Mathematica 2.2 for Solaris on a Sparc 20 workstation." and page 12, paragraphs 4 and 5: "SPRA means that the shortest route is always used to route a clear-channel on the physical network. In our case, the length of a route is the number of optical links it uses. At each step of the global iteration, a Tabu Search is performed, starting from the initial solution of this step."). Armitage et al. as modified by Wang do not disclose using the

maximum time delay and the relative time delay as cost metrics to identify the optimal mapping. Nonetheless, Examiner takes Official Notice that it is notoriously well-known in the art to use quality of service attributes, such as delay, in defining link costs. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use maximum time delay and relative time delay as cost metrics in the computer system for identifying optimal mapping of logical links onto the physical network topology as in Armitage et al. as modified by Wang for the purpose of selecting the optimal logical path that meets defined time constraints.

Claims 17 and **18** are rejected under 35 U.S.C. 103 as being unpatentable over **Armitage et al. ("Design of a Survivable WDM Photonic Network ")** in view of **Wang (U.S. Patent # 5500808),** as applied to claim 16 above, and further in view of **Doverspike et al. (U.S. Patent Application Publication No. 2002/0097671 A1).**

Consider **claim 17**, and as applied to claim 16, Armitage et al. in view of Wang do not disclose a wavelength sub-module. However, Doverspike et al. clearly show and disclose a wavelength module for obtaining the availability of wavelengths in the network (Fig. 1 and Col. 2, paragraph [0013]: "With reference to Fig. 1, optical mesh network 100 comprises optical cross-connects (OXCs) and optical transport systems (OTSs)." and "The optical transport systems in Fig. 1 comprise pairs of bidirectional Wavelength Division Multiplexer (WDM) terminals ... The WDM terminals multiplex optical signals at different wavelengths into a single optical fiber for each direction of transmission." and Col. 1, paragraph [0006]: "Weights are computed for the links using

an array representing a restoration link capacity – which is expressed as a number of channels/wavelengths in optical networking…"). Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use the module for obtaining the availability of wavelengths in a network as taught by Doverspike et al. in the computer system of Armitage et al. in view of Wang for the purpose of using wavelength availability as a criteria in identifying the optimal mapping of logical links to the physical topology of the network.

Consider **claim 18,** and as applied to claim 17, Armitage et al. as modified by Wang and Doverspike et al. clearly show and disclose a computer system wherein the correlation module coupled with the practical constraint module correlates the mapping options with a path cost metric (page 13, Simulation Results: "The DAP Algorithm has been implemented in Mathematica 2.2 for Solaris on a Sparc 20 workstation." and page 12, paragraphs 4 and 5: "SPRA means that the shortest route is always used to route a clear-channel on the physical network. In our case, the length of a route is the number of optical links it uses. At each step of the global iteration, a Tabu Search is performed, starting from the initial solution of this step." and page 16, Conclusion, paragraph 7: "Our future work will be oriented towards the introduction of maximal capacity for the optical links and nodes (i.e. having a maximum number of channels per fibre …"). Armitage et al. as modified by Wang and Doverspike et al. do not disclose using the maximum time delay and the relative time delay as cost metrics to identify the optimal mapping. Nonetheless, Examiner takes Official Notice that it is notoriously well-known in the art to use quality of service attributes, such as delay, in defining link costs.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use maximum time delay and relative time delay as cost metrics in the computer system for identifying optimal mapping of logical links onto the physical network topology as in Armitage et al., Wang and Doverspike et al. for the purpose of selecting the optimal logical path that meets defined time constraints.

Claim 20 is rejected under 35 U.S.C. 103 as being unpatentable over **Armitage et al. ("Design of a Survivable WDM Photonic Network ")** in view of **Wang (U.S. Patent # 5500808)** and further in view of **Doverspike et al. (U.S. Patent Application Publication No. 2002/0097671 A1)** and further in view of **Nucci et al. ("Design of Fault-Tolerant Logical Topologies in Wavelength-Routed Optical IP Networks").**

Consider **claim 20**, and as applied claim 18, Armitage et al. as modified by Wang and Doverspike et al. do not disclose that the correlation module utilizes a Tabu search methodology to perform the correlation. However, Nucci et al. clearly show and disclose a correlation module that uses a Tabu search methodology to find the optimal mapping of logical links to the physical topology of a network (Section IV, Tabu Search for the SLTDP: "The heuristic we propose to use in the solution of SLTDP relies on the application of the Tabu Search (TS) methodology...TS is based on a partial exploration of the space of admissible solutions ... The exploration starts from an initial solution that is generally obtained with a greedy algorithm, and when a stop criterion is satisfied, the algorithm returns the best visited solution." and Section II, Problem Statement: "The Survivable Logical Topology Design Problem (SLTDP) under a given unicast and

multicast traffic pattern can be stated ..."). Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate a correlation module that utilizes a Tabu search methodology as taught by Nucci et al. in the computer system for identifying optimal mapping of logical links to the physical topology of a network as in Armitage et al., Wang and Doverspike et al. for the purpose of solving the optimization problem.

Claims 19 and **21** are rejected under 35 U.S.C. 103 as being unpatentable over **Armitage et al. ("Design of a Survivable WDM Photonic Network ")** in view of **Wang (U.S. Patent # 5500808)** and further in view of **Doverspike et al. (U.S. Patent Application Publication No. 2002/0097671 A1)** and further in view of **Modiano et al. (Survivable Routing of Logical Topologies in WDM Networks).**

Consider **claim 19**, and as applied to claim 18, Armitage et al. as modified by Wang and Doverspike et al. do not disclose that the correlation module utilizes an integer linear program to perform the correlation. However, Modiano et al. clearly show and disclose a correlation module that uses an integer linear program to find the optimal mapping of logical links to the physical topology of a network (Section III, Integer Linear Programming Formulation, paragraph 1: "Using Theorem I, we are able to formulate the problem of survivable routing of a logical topology on a given physical topology as an Integer Linear Program (ILP)." and paragraph 8: "We implemented this ILP using the CPLEX software package. CPLEX uses branch and bound techniques for solving ILPs and is capable of solving ILPs consisting of up to one million variables and

constraints."). Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use an integer linear program correlation module as taught by Modiano et al. in the computer system for identifying optimal mapping of logical links to the physical topology of a network as in Armitage et al., Wang and Doverspike et al. for the purpose of solving the optimization problem.

Consider **claim 21**, and as applied to claim 18, Armitage et al. as modified by Wang and Doverspike et al. do not disclose performing the correlation to identify the optimal mapping for a large Internet network backbone. However, Modiano et al. clearly show and disclose performing the correlation on the NSFNET (III. Integer Linear Programming formulation, paragraph 8: "To illustrate the utility of this approach, we implemented the ILP for the NSFNET physical topology ..."). Modiano does not specifically disclose that the NSFNET is a large Internet backbone. The Examiner takes Official Notice that it is notoriously well-known in the art that the NSFNET is a large Internet network backbone. Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to perform the correlation to identify the optimal mapping on the NSFNET as taught by Modiano et al. in the computer system for identifying optimal mapping of logical links onto the physical topology of a network, as in Armitage et al., Wang and Doverspike et al. for the purpose of solving the optimization problem for a large Internet network backbone.

Claims 22, 23, 24, 25, 26 are rejected under 35 U.S.C. 103 as being unpatentable over **Doverspike et al. (U.S. Patent Application Publication # 2002/0097671 A1)** in view of **Wang (U.S. Patent # 5500808).**

Consider **claim 22**, Doverspike et al. clearly show and disclose a system for identifying optimal mapping of logical links to the physical topology of the network, comprising: means for obtaining one or more mapping options for mapping multiple logical links between one or more pairs of network nodes onto physical paths that are at least relatively disjoint and means for identifying the optimal mapping using a cost metric to assign a weight to the paths (Fig. 1 and Col. 1, paragraph [0012]: "Fig. 1 is a mesh network 100, illustratively an optical network, organized into a general topology of links and nodes ..." and Col. 2, paragraph [0013]: "With reference to Fig. 1, optical mesh network 100 comprises optical cross-connects (OXCs) and optical transport systems (OTSs)." and Col. 1, paragraph [0006]: "The restoration path is selected from a graph of links in the network which are physically diverse from the service path. For example, in the context of optical networking, the links do not share a common fiber span with the service path." and Col. 3, paragraph [0021]: "Selecting a service path in response to the communication request, accordingly, may be accomplished by computing a path between the source and destination that minimizes some cost metric and which has the required size for the connection request. It is assumed that each OXC node has knowledge of the whole optical network topology and the number of free channels on each link as well as some optical link weight function. A known shortest path algorithm such as Dijkstra's shortest path algorithm may be used to compute the

minimal weight path through the network." and Col. 3, paragraph [0019]: "The process of computation of service path and restoration path for a connection request relies on the information about the availability of optical network resources and the path selection objective. A general heuristic is to create some cost metric and select a "minimum weight" path among all suitable paths that minimizes the cost metric and has the required size for the connection request."). Doverspike et al. do not disclose means for obtaining a maximum time delay allowed between each pair of network nodes and using this time delay as the cost metric to identify the optimal mapping. However, Wang clearly shows and discloses means for obtaining a maximum time delay (Col. 8, lines 35 – 40: "Means for generating absolute time values 230, in response to the signals from simulating means 210, 220 combines and scales the signals to obtain an absolute value of the time delay in the mapped and optimized logic network that is associated with the unmapped logic node being processed."). Therefore, it would have been obvious to a person of ordinary skill at the time the invention was made to use the means for obtaining a maximum time delay as taught by Wang in the system for identifying optimal mapping of logical links in Doverspike et al. for the purpose of selecting the optimal logical path that meets a defined time constraint.

Consider **claim 23**, and as applied to claim 22, Doverspike et al. do not disclose obtaining a relative time delay allowed between two or more physical paths. However, Wang clearly shows and discloses obtaining a relative time delay (Col. 2, lines 64 – 66: "In one improvement, referred to as the level-fanout model, a function of the fanout at a logic node is added to the constant time delay of the level model. " and Col. 3, lines 18

–20: "… the time delays are at best relative measures, which can only be used for comparisons with each other …). Therefore, it would have been obvious to a person of ordinary skill at the time the invention was made to use the means for obtaining a relative time delay as taught by Wang in the system for identifying optimal mapping of logical links as in Doverspike et al. for the purpose of using relative time delay between physical paths as a cost metric in identifying the optimal mapping.

Consider **claim 24**, and as applied to claim 23, Doverspike et al. as modified by Wang clearly show and disclose means for identifying the optimal mapping of logical links using a cost metric to assign a weight to the paths (Fig. 1 and Col. 1, paragraph [0012]: "Fig. 1 is a mesh network 100, illustratively an optical network, organized into a general topology of links and nodes …" and Col. 2, paragraph [0013]: "With reference to Fig. 1, optical mesh network 100 comprises optical cross-connects (OXCs) and optical transport systems (OTSs)." and Col. 3, paragraph [0019]: "The process of computation of service path and restoration path for a connection request relies on the information about the availability of optical network resources and the path selection objective. A general heuristic is to create some cost metric and select a "minimum weight" path among all suitable paths that minimizes the cost metric and has the required size for the connection request."). Doverspike et al. do not disclose using the maximum time delay and the relative time delay as cost metrics to identify the optimal mapping. Nonetheless, Examiner takes Official Notice that it is notoriously well-known in the art to use quality of service attributes, such as delay, in defining link costs. Therefore, it would have been obvious to a person of ordinary skill in the art at the time

the invention was made to use maximum time delay and relative time delay as cost metrics in the system for identifying optimal mapping of logical links to the physical network topology as in Doverspike et al. and Wang for the purpose of selecting the optimal logical path that meets defined time constraints.

Consider **claim 25**, and as applied to claim 24, Doverspike et al. as modified by Wang clearly show and disclose means for obtaining the availability of wavelengths in the network (Fig. 1 and Col. 2, paragraph [0013]: "With reference to Fig. 1, optical mesh network 100 comprises optical cross-connects (OXCs) and optical transport systems (OTSs)." and "The optical transport systems in Fig. 1 comprise pairs of bidirectional Wavelength Division Multiplexer (WDM) terminals ... The WDM terminals multiplex optical signals at different wavelengths into a single optical fiber for each direction of transmission." and Col. 1, paragraph [0006]: "Weights are computed for the links using an array representing a restoration link capacity – which is expressed as a number of channels/wavelengths in optical networking...").

Consider **claim 26**, and as applied to claim 25, Doverspike et al. clearly show and disclose means for identifying the optimal mapping of logical links using a cost metric to assign a weight to the paths (Fig. 1 and Col. 1, paragraph [0012]: "Fig. 1 is a mesh network 100, illustratively an optical network, organized into a general topology of links and nodes ..." and Col. 2, paragraph [0013]: "With reference to Fig. 1, optical mesh network 100 comprises optical cross-connects (OXCs) and optical transport systems (OTSs)." and Col. 3, paragraph [0019]: "The process of computation of service path and restoration path for a connection request relies on the information about the

availability of optical network resources and the path selection objective. A general heuristic is to create some cost metric and select a "minimum weight" path among all suitable paths that minimizes the cost metric and has the required size for the connection request."). Doverspike et al. also disclose that link capacity is expressed as a number of wavelengths in optical networking (Col. 1, paragraph [0006]: "Weights are computed for the links using an array representing a restoration link capacity – which is expressed as a number of channels/wavelengths in optical networking…"). Doverspike et al. as modified by Wang do not disclose using the maximum time delay, the relative time delay and the link capacity as cost metrics to identify the optimal mapping. Nonetheless, Examiner takes Official Notice that it is notoriously well-known in the art to use quality of service attributes, such as delay, and link attributes, such as capacity, in defining link costs. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use maximum time delay, relative time delay and wavelength availability as cost metrics in the system for identifying optimal mapping of logical links to the physical network topology as in Doverspike et al. and Wang for the purpose of selecting the optimal logical path.

Claims 27 and **28** are rejected under 35 U.S.C. 103 as being unpatentable over **Doverspike et al. (U.S. Patent Application Publication # 2002/0097671 A1)** in view of **Wang (U.S. Patent # 5500808),** as applied to claim 26 above, and further in view of **Nishiyama et al. (European Patent # EP950966)**.

Consider **claim 27**, and as applied to claim 26, Doverspike et al. as modified by Wang do not disclose obtaining a priority order of the network node pairs. However, Nishiyama et al. clearly show and disclose means for obtaining a priority order of the network node pairs (Fig. 1 and paragraph [0024]: "In the reference level position determination 12, the system determines positional relationships … " and paragraph [0009]: "… the object above can be achieved in the method by providing a sixth step in which when positional relationships between nodes at a reference level or nodes as a reference of placements are determined, … and a seventh step for determining positional relationships such that a pair having the higher priority is located at the nearer position."). Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to incorporate means for obtaining a priority order of the network node pairs as in Nishiyama et al. into the system for identifying optimal mapping of logical links to the physical topology of a network as in Doverspike et al. and Wang for the purpose of using the priority order of the network node pairs in determining the optimal logical link mapping.

Consider **claim 28**, and as applied to claim 27, Doverspike et al. as modified by Wang clearly show and disclose means for identifying the optimal mapping of logical links using a cost metric to assign a weight to the paths (Fig. 1 and Col. 1, paragraph [0012]: "Fig. 1 is a mesh network 100, illustratively an optical network, organized into a general topology of links and nodes …" and Col. 2, paragraph [0013]: "With reference to Fig. 1, optical mesh network 100 comprises optical cross-connects (OXCs) and optical transport systems (OTSs)." and Col. 3, paragraph [0019]: "The process of

computation of service path and restoration path for a connection request relies on the information about the availability of optical network resources and the path selection objective. A general heuristic is to create some cost metric and select a "minimum weight" path among all suitable paths that minimizes the cost metric and has the required size for the connection request."). Doverspike et al. also disclose that link capacity is expressed as a number of wavelengths in optical networking (Col. 1, paragraph [0006]: "Weights are computed for the links using an array representing a restoration link capacity – which is expressed as a number of channels/wavelengths in optical networking…"). Doverspike et al. as modified by Wang do not disclose means for obtaining a priority order of the network node pairs. However, Nishiyama et al. clearly show and disclose means for obtaining a priority order of the network node pairs (Fig. 1 and paragraph [0024]: "In the reference level position determination 12, the system determines positional relationships … " and paragraph [0009]: "… the object above can be achieved in the method by providing a sixth step in which when positional relationships between nodes at a reference level or nodes as a reference of placements are determined, … and a seventh step for determining positional relationships such that a pair having the higher priority is located at the nearer position."). Doverspike et al. in view of Wang and Nishiyama et al. do not disclose using the maximum time delay, the relative time delay, the link capacity and the priority order of the network node pairs as cost metrics to identify the optimal mapping. Nonetheless, Examiner takes Official Notice that it is notoriously well-known in the art to use quality of service attributes, such as delay, link attributes, such as capacity, and network connection attributes such as

network node priority order in defining link costs. Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to use maximum time delay, relative time delay, wavelength availability and network node priority order as cost metrics in the system for identifying optimal mapping of logical links to the physical network topology as in Doverspike et al., Wang and Nishiyama et al. for the purpose of selecting the optimal logical path.

Conclusion

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If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Rafael Perez-Gutierrez can be reached at (571) 272-7915. The fax phone

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Leah Richmond
L.L.R./llr

February 5, 2007

RAFAEL PEREZ-GUTIERREZ
SUPERVISORY PATENT EXAMINER
2/12/07